SUSTAINABLE LIVING TASMANIA

Sustainable Living Information

Passive Solar House Design

Passive solar house design is well suited to Tasmania's cool temperate climate – cold damp winters, warm dry summers and variable spring and autumn months.

Elements of passive solar design include:

- a northerly building orientation with the majority of windows and living areas facing north, and minimal windows on south, west and east sides
- good insulation in the ceiling, walls, slab edge or under-house (for suspended floors)
- internal thermal mass to absorb solar heat – concrete slab floors with dark ceramic tiles and internal brick or stone walls where light falls on them directly
- double glazing, heavy curtains and box pelmets

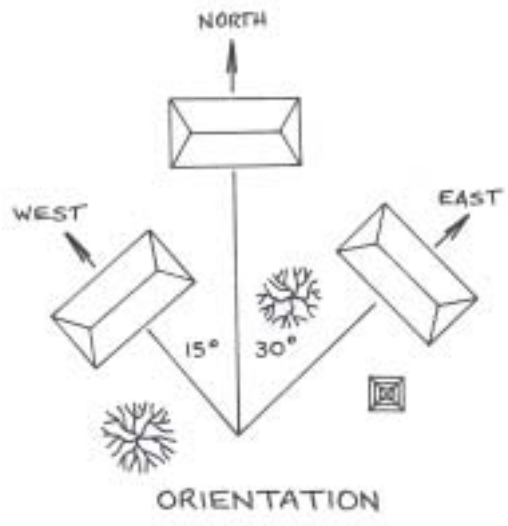
Low winter sun enters the northerly windows and is absorbed by the internal thermal mass. At night, as the air temperature cools, the stored heat is released into the room. Temperature loss to the outside is prevented by good insulation, double glazing, thick curtains and pelmets.

In summer, when the sun is high overhead, the eaves exclude direct sun with the help of window shading devices such as pergolas, deciduous trees or awnings.

Adult Education runs a Sustainable Housing Design course. It covers: choice of suitable building materials; energy efficient housing design guidelines; solar electricity systems; water recycling and conservation methods; building biology and health effects in housing.

Orientation

Site the house so that the long axis with the most used living areas and largest areas of glazing face north. This allows standard-sized eaves (450mm with 150mm gutters) to admit low winter sun but exclude summer sun.



A variation of 15^{o} west and 30^{o} east of north is still considered acceptable for passive solar design. (A westerly orientation will overheat in summer, south and east orientations will require much more winter heating.)

Insulation

Insulation prevents unwanted summer heat coming into the house as well as winter heat escaping. There are two types of insulation, reflective and bulk. Bulk insulation (e.g. wool, fibreglass or polyester batts) reduces energy flow by conduction. Reflective foils reduce the flow of heat by radiation and low-emission. Reflective foils need a space of at least 25mm between the foil and the cladding.

The R-value measures the thermal resistance to heat flow through insulation materials. The higher the R-value, the better the thermal resistance. Different R-values are recommended for different climatic regions and in different parts of the house.

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Ceilings: Up to 35% of heat loss is through the ceiling. The building code for Tasmania recommends R3.5 in ceilings and R4.0 for buildings in cold, elevated areas.

Walls: Up to 25% of heat loss is through the walls. A minimum of R2.0 is recommended in wall cavities.

Floors: Up to 20% of heat loss is through the floor. A minimum of R1.5 underneath wooden floors is recommended (placed between the joists). Concrete slab edges should be insulated with polystyrene sheets.

Windows: Up to 35% of heat can be lost through windows. Double-glazing can reduce heat loss by 60%. Good curtains and pelmets can reduce heat loss by up to 45%.

Drafts: Drafts can account for up to 25% of heat loss, so good draft sealing is important.

Note: A combination of bulk (keep heat in) and foil (keep unwanted heat out) insulation is useful.

Vapour Barriers

When warm air holding moisture (from cooking and people breathing) reaches a colder surface, it will condense and form water droplets. Warm moist air can pass through timber or plasterboard walls and ceilings so it is important to have a vapour barrier on the warm side of the insulation. This can consist of joined sheets of plastic between the walls and the insulation (installed during construction) or waterproof paint on the

walls and ceilings. This will prevent the risk of condensation dripping into ceiling and wall cavities and causing unseen rot.

Windows

Windows are the greatest source of heat loss and gain in a house. In Tasmania, northerly windows should account for about 75% of the wall area as they will gain more winter sun during the day than they will lose at night. Easterly windows should be about 15%, west 5% and on the south side as minimal as possible while still allowing for adequate natural light. See Sustainable Living Information Sheet on Windows for more information.

Window Energy Rating Scheme (WERS)

The window energy rating scheme (WERS) gives a star rating for the heating and cooling performance of windows – the glass and framing materials. In Tasmania, windows should be designed to keep heat inside (used in conjunction with summer shading methods to keep it out). Choose windows with the best star rating in the heating section (shown in red – cooling performance is shown in blue.)

Window manufacturers will provide a certificate of information on the energy performance of their windows as well as the WERS sticker.

There is also a Skylight Energy Rating Scheme (SERS).

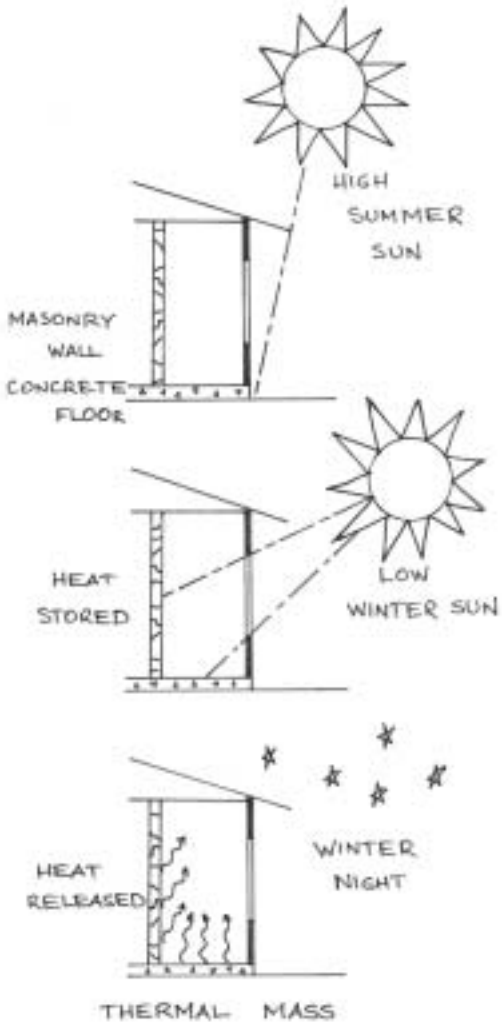
See separate Sustainable Living Guide on Windows for more information.

Thermal Mass

Much of the winter sun passing through windows falls on the floor so a concrete slab with dark tinting or laid with dark ceramic tiles or slate will make the most efficient thermal mass. Floor coverings such as carpets, cork tiles or mats will reduce the absorption of heat.

Internal walls made from brick, rock, mud brick, rammed earth or containers filled with water will provide good thermal mass especially when positioned where the sun falls directly onto them. (External walls made from thermal mass materials need to be well insulated as internal heat will be lost

to the outside.) Thermal mass should be located on north facing walls and floors for maximum benefit.



Thermal Mass of Different Materials

Material	*Normal Thickness*	*Heat Storage Capacity ($KJ/m^2\,^oC$)*
Concrete floor	100mm	200
Clay brick	90mm	120
Timber floor	19mm	18
Glass	3mm	1

The denser the material (i.e. least air gaps) the greater the thermal mass.

Curtains

Make sure curtains cover the whole window, coming well below the windowsill, and to floor level if possible.

Choose a dense, tightly woven fabric with a lining for extra insulation.

Box pelmets will prevent warm air being drawn down between the window and the curtain and bringing cold air back into the room.

Suppliers

These suppliers have exhibited at our Sustainable Living Expo:

Insulate Tasmania Pty Ltd, PO Box 1119, Glenorchy, 6271 3411.

Cool or Cosy Tasmania, 111-113 Howard Rd, Goodwood, 6272 1699.

Stonetech Building Products - *CSR Hebel*, 28 McIntyre St, Mornington 6245 1200

Timbercrete, PO Box 318 Margate, 6267 1683. www.timbercrete.com.au

See separate Sustainable Living Guide on Windows for a list of window suppliers.

For info on passive solar architects see the 2006 Environmental Home Expo catalogue http://www.tasmanianenvironmentcentre.org.au/projects/documents/HomeExpo_catalogue06.pdf

References

Your Home Technical Manual (available from SLT bookshop and library) http://www.greenhouse.gov.au/yourhome/

Australia & New Zealand Solar Energy Society. *Solar Kit*, 1994

Hobart City Council. *Energy Efficiency Design Guidelines*, 2003

For more information, see the Sustainable Living Tasmania Environment Resource Library and ANZSES-Tasmanian Branch, PO Box 121, Sandy Bay TAS 7005.

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